FOREST SERVICE RESEARCH NOTE NE-45
1966

Northeastern Forest
FOREST SERVICE, U.S. DEPT. OF AGRICULTURE, 102 MOTORS AVENUE, UPPER DARBY, PA.
Experiment Station

# AERIAL SPRAYING OF LOW-GRADE HARDWOOD STANDS WITH 2,4,5-T IN WEST VIRGINIA

Aerial application of herbicides to poor hardwood stands shows promise of being an effective aid in converting stands of low-grade hardwoods to conifers in West Virginia. Many of the sites now occupied by low-grade hardwoods are incapable of producing quality hardwoods — even under good management — and are generally much better suited to certain conifers, particularly the native pine.

This report describes the results of an aerial application of herbicide by helicopter to the hardwoods on such a site where partial conversion to white pine by aerial seeding is planned. The study was carried out on the Monongahela National Forest in cooperation with the timber management staff and the District Ranger personnel of the Marlinton Ranger District. The National Forest provided the land, supervised the cutting, paid for the aerial spraying, and assisted in the field measurements.



## Study Area

The treated area consisted of two cutover plots and two uncut plots, each 8 acres in size, located near each other on a steep (average 55 percent) southwest-facing slope near Huntersville, West Virginia. Site index for the area was about 55 feet for oak.

Before the two plots were cut, the stand was well stocked with about 75 square feet of basal area per acre in trees over 5 inches d.b.h. Stand age was about 69 years. The species composition was: northern red oak (*Quercus rubra* L.), white oak (*Q. alba* L.), chestnut oak (*Q. prinus* L.), and scarlet oak (*Q. coccinea* Muenchh.) — 40 percent; shagbark hickory (*Carya ovata* (Mill.) K. Koch) and mockernut hickory (*C. tomentosa*

Nutt.) — 22 percent; sugar maple (*Acer saccharum* Marsh.) — 9 percent; flowering dogwood (*Cornus florida*) — 8 percent; downy serviceberry (*Amelanchier arborea* (Michx. f.) Fern.) — 5 percent; Virginia pine (*Pinus virginiana* Mill.) and pitch pine (*P. rigida* Mill.) — 4 percent; red maple (*Acer rubrum* L.) — 3 percent; and other species — 9 percent.

On the two logged plots, all trees down to about 5 inches d.b.h. had been cut and skidded out for pulpwood between February and August 1963.

## Application of Herbicide

On August 15, 1963, the four plots were sprayed by helicopter with 2 pounds of 2,4,5-T acid equivalent per acre in oil (1/3 gallon of a 6-pound-per-gallon iso-octyl ester formulation in 4.5 gallons of No. 2 fuel oil). The spray was applied through a conventional boom-type spray rig mounted on the helicopter. Weather conditions were ideal during the operation; the day was calm and visibility was excellent. Total spraying time was 50 minutes, which included 4 trips to the landing area, 2 miles distant, for reloading.

As a check on the distribution of the herbicide and penetration through the canopy, twenty-five 4- by 5-inch oil-sensitive cards were placed in a line at 20-foot intervals from the bottom of the slope to the top in each plot. The cards on the cutover plots were heavily spattered with oil droplets, indicating good coverage. All cards on the uncut areas were lightly spattered, indicating good coverage of the area and heavy retention of spray in the tree canopy.

## Results

A year later, in August 1964, the plots were checked to determine the effectiveness of the herbicide treatment. On the cutover plots, most of the small scattered trees left after logging were dead but most of the stumps of cut trees were sprouting. On the uncut plots, the trees were tallied by species in 2-inch diameter classes under four degrees of crown damage, following the method of Roe.[1] The tallies were taken on 16 permanent 1/20-acre subplots in each of the two uncut main plots. The crown damage classes used were:

**Dead** = more than 80% defoliated.
**Severe** = 50 to 80% defoliated.
**Light** = 20 to 50% defoliated.
**None** = less than 20% defoliated.

[1] Roe, Eugene I. Measuring the Results of Aerial Spraying with Herbicides for Forestry Purposes. U. S. Forest Serv. Lake States Forest Expt. Sta. Tech. Note 492, 2 pp. 1957.

Figure 1. — General condition of overstory trees 1 year after aerial spraying with 2,4,5-T.

In addition, the number of spray-killed understory stems below 1.0 inch d.b.h. was tallied on a 1/100-acre subplot at each sampling point.

The overall killing effect of the spray on the overstory was good (fig. 1). It was most effective on the four oak species: more than 90 percent of the trees were dead or severely defoliated. Red maple, black locust, and basswood were the next most susceptible group: 69 percent dead or severely defoliated. Sugar maple was intermediate: 39 percent dead or severely defoliated. The hickories, serviceberry, dogwood, and crataegus were only slightly affected. Pitch pine and Virginia pine showed no damage (table 1).

No relationship between tree size and susceptibility to the spray treatment was apparent. The highly susceptible oaks were deadened in all size classes and the more resistant hickories were about equally resistant in all size classes. About 9 percent of the stems below 1.0 inch d.b.h. — chiefly mountain laurel, witch hazel, serviceberry, dogwood, and small tree seedlings — were deadened on the unlogged plots.

Table 1. — *Effectiveness of aerial spray, by species*

| Species | Trees examined | Damage class | | | |
|---|---|---|---|---|---|
| | | Dead | Severe | Light | None |
| | *No.* | % | % | % | % |
| White oak | 176 | 88 | 4 | 4 | 4 |
| Hickories | 95 | 18 | 5 | 5 | 72 |
| Serviceberry | 71 | 25 | 13 | 21 | 41 |
| Red and scarlet oaks | 69 | 91 | — | 4 | 5 |
| Virginia and pitch pines | 58 | — | — | — | 100 |
| Chestnut oak | 48 | 79 | 11 | 5 | 5 |
| Sugar maple | 41 | 39 | — | 15 | 46 |
| Dogwood | 23 | 22 | — | 4 | 74 |
| Red maple | 13 | 69 | — | 8 | 23 |
| Black locust | 10 | 90 | — | — | 10 |
| Hophornbeam | 11 | 18 | 10 | 27 | 45 |
| Crataegus | 11 | — | — | 9 | 91 |
| Witch hazel | 10 | 90 | — | — | 10 |
| Basswood | 6 | 83 | — | — | 17 |

## Discussion

Partial conversion of hardwood stands to pine requires that some method be employed to reduce the hardwood competition. In uncut stands similar to those on our study area, aerial application of 2,4,5-T shows promise of being such a method. This treatment appears especially promising where the stands are composed chiefly of oaks. However, one spraying does not bring about much reduction of the understory, as most of the chemical is caught in the tree crowns.

In this study the herbicide was applied in late summer and white pine seeds were sown the following spring (1964). No data on the success of the seeding are yet available. However, it is recognized that the undisturbed forest floor is a relatively unfavorable seedbed for pine, and that catches of seedlings are likely to be light under these conditions.

Also, by hindsight, we suspect that the sequence followed in the trial was a poor choice because the released understory is likely to take over the site before any pine seedlings starting from the seeding have become well enough established to hold their own. A follow-up treatment probably will be required to release these pines.

A better sequence might be to seed first, and delay the herbicide treatment a few years until an adequate number of pine seedlings are established. Released from the overstory at this stage, many of the pine seedlings could be expected to compete successfully with the understory vegetation.

On cutover areas, the logging, besides removing most of the overstory, creates better seedbed conditions to the extent that mineral soil or intermixed soil and humus are exposed. However, unless the stumps are individually treated, rampant sprouting will follow the cutting. The spray treatment applied shortly after the logging in our study did not inhibit sprouting to any substantial degree, and a follow-up treatment probably will be necessary.

As in unlogged areas, timing may be the key to success. It now appears that seeding should be done at once on cutover areas to take advantage of the improved seedbeds, but that the spraying should be delayed 4 or 5 years. By that time the sprouts will have made considerable growth and will be susceptible to foliage treatment. One treatment then should suffice to release the pines.

— GEORGE W. WENDEL
Associate Silviculturist
Northeastern Forest Experiment Station
Forest Service, U. S. Dept. Agriculture
Parsons, West Virginia